

CLAIMS

What is claimed is:

- 5 1. An implantable cardiac lead, comprising:
a lead body;
an electrode supported by the lead body, the electrode configured for
subcutaneous non-intrathoracic placement within a patient; and
a driving arrangement coupled to the lead, the driving arrangement configured
10 to provide phoresis delivery of a pharmacological agent from the lead to
subcutaneous tissue.

- 15 2. The lead according to claim 1, wherein the driving arrangement
comprises the electrode supported by the lead body, the electrode configured for
one or both of cardiac monitoring and stimulation.

- 20 3. The lead according to claim 1, wherein the driving arrangement
comprises a transducer adapted to provide sonophoresis.

- 25 4. The lead according to claim 1, wherein the electrode is configured as
an electrode array, and the driving arrangement comprises the electrode array.

- 30 5. The lead according to claim 1, wherein the driving arrangement
comprises a conductor adapted to provide electrophoresis.

- 35 6. The lead according to claim 1, wherein the pharmacological agent
provides therapeutic treatment localized to an area substantially surrounding at least
a portion of a subcutaneous dissection path.

7. The lead according to claim 1, wherein the pharmacological agent is provided at a plurality of locations on the lead body.

5 8. The lead according to claim 1, wherein the pharmacological agent is impregnated into a membrane provided on the lead.

9. The lead according to claim 1, wherein the lead further comprises a collar, the pharmacological agent provided at the collar.

10 10. The lead according to claim 1, wherein the lead further comprises a polymeric structure, the pharmacological agent infused within the polymeric structure.

15 11. The lead according to claim 1, wherein the lead further comprises a porous region, the pharmacological agent at least partially filling pores of the porous region.

12. The lead according to claim 11, wherein the porous region
20 comprises a doped polymer matrix.

13. The lead according to claim 1, wherein the pharmacological agent is disposed in a coating on the lead.

25 14. The lead according to claim 1, wherein the pharmacological agent comprises an analgesic or an anesthetic.

15. The lead according to claim 1, wherein the pharmacological agent

comprises an antibiotic or an antiseptic.

16. The lead according to claim 1, wherein the pharmacological agent comprises a steroid or an anti-inflammatory agent.

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17. The lead according to claim 1, wherein the pharmacological agent comprises an agent that promotes hemostasis or provides vasoconstriction.

18. An implantable system, comprising:

10 a lead, comprising:

a lead body; and

an electrode coupled to the lead body, the electrode configured for subcutaneous non-intrathoracic placement within a patient; and

15 a can coupled to the lead, the can configured to provide phoresis delivery of a pharmacological agent from at least a portion of the can to subcutaneous tissue.

19. The system according to claim 18, wherein the can is configured to provide electrophoresis.

20 20. The system according to claim 18, wherein the can is configured to provide sonophoresis.

21. The system according to claim 18, further comprising a driving arrangement provided on the lead and configured to provide phoresis delivery of a pharmacological agent from at least a portion of the lead to the subcutaneous tissue.

22. The system according to claim 18, wherein the lead and the can are configured to produce an electric potential between the lead and the can, the electric potential produced to provide the phoresis delivery of the pharmacological agent.

5 23. The system according to claim 18, wherein the pharmacological agent is impregnated into a membrane provided on the can.

10 24. The system according to claim 18, wherein the can comprises a reservoir fluidly coupled to a port defined on the portion of the can, the reservoir comprising one or more chambers for storing one or more pharmacological agents.

25. The system according to claim 18, wherein the can comprises a porous region, the pharmacological agent at least partially filling pores of the porous region.

15 26. The system according to claim 25, wherein the porous region comprises a doped polymer matrix.

20 27. The system according to claim 18, wherein the pharmacological agent is disposed in a coating on the can.

28. The system according to claim 27, wherein the coating covers at least 25% of a surface area of the can.

25 29. The system according to claim 18, wherein the pharmacological agent comprises an analgesic or an anesthetic.

30. The system according to claim 18, wherein the pharmacological agent comprises an antibiotic or an antiseptic.

31. The system according to claim 18, wherein the pharmacological agent comprises a steroid or an anti-inflammatory agent.

5 32. The system according to claim 18, wherein the pharmacological agent comprises an agent that promotes hemostasis or provides vasoconstriction.

33. A method of lead implantation, comprising:

delivering a lead into subcutaneous non-intrathoracic tissue of a

10 patient, the lead comprising a lead body, an electrode, and a pharmacological agent on the lead; and

impelling, using phoresis, the pharmacological agent from at least a portion of the lead to the subcutaneous non-intrathoracic tissue.

15 34. The method according to claim 33, wherein impelling the pharmacological agent comprises generating an electric field for impelling the pharmacological agent using electrophoresis.

20 35. The method according to claim 33, wherein impelling the pharmacological agent comprises generating ultrasonic waves for impelling the pharmacological agent ultrasonically.

25 36. The method according to claim 33, wherein impelling the pharmacological agent using phoresis comprises impelling a plurality of pharmacological agents.

37. The method according to claim 33, wherein impelling the pharmacological agent comprises impelling a first pharmacological agent using electrophoresis and impelling a second pharmacological agent using sonophoresis.

5 38. The method according to claim 33, further comprising delivering a can into subcutaneous non-intrathoracic tissue of the patient, the can comprising an electrode or an electrically conductive region, and a pharmacological agent; and
10 impelling, using phoresis, the pharmacological agent from at least a portion of the can to the subcutaneous non-intrathoracic tissue.

39. The method according to claim 38, wherein impelling the pharmacological agent from the can comprises generating an electric field for impelling the pharmacological agent from the can using electrophoresis.

15 40. The method according to claim 38, wherein impelling the pharmacological agent comprises generating ultrasonic waves for impelling the pharmacological agent ultrasonically from the can.

20 41. The method according to claim 38, wherein impelling the pharmacological agent from the can using phoresis comprises impelling a plurality of pharmacological agents from the can.

25 42. The method according to claim 38, wherein impelling the pharmacological agent from the can comprises impelling a first pharmacological agent using electrophoresis and impelling a second pharmacological agent using sonophoresis.

43. The method according to claim 33, further comprising:
providing a removable sheath having a lumen;
advancing the lead through the lumen to an implant location; and
removing the sheath from the lead with the lead remaining at the
implant location.

5 44. The method according to claim 33, wherein the pharmacological agent
comprises an analgesic or an anesthetic.

10 45. The method according to claim 33, wherein the pharmacological agent
comprises an antibiotic or an antiseptic.

15 46. The method according to claim 33, wherein the pharmacological agent
comprises a steroid or an anti-inflammatory agent.

15 47. The method according to claim 33, wherein the pharmacological agent
comprises an agent that promotes hemostasis or provides vasoconstriction.

20 48. An implantable cardiac lead, comprising:
a lead body;
an electrode coupled to the lead body, the electrode configured for
subcutaneous non-intrathoracic placement in a patient; and
means, coupled to the implantable lead, for impelling a
pharmacological agent using phoresis into subcutaneous non-intrathoracic tissue.

25 49. The lead according to claim 48, wherein the impelling means comprises
means for impelling the pharmacological agent using electrophoresis.

50. The lead according to claim 48, wherein the impelling means comprises means for impelling the pharmacological agent using sonophoresis.

51. The lead according to claim 48, wherein the pharmacological agent
5 comprises an analgesic or an anesthetic.

52. The lead according to claim 48, wherein the pharmacological agent comprises an antibiotic or an antiseptic.

10 53. The lead according to claim 48, wherein the pharmacological agent comprises a steroid or an anti-inflammatory agent.

54. The lead according to claim 48, wherein the pharmacological agent comprises an agent that promotes hemostasis or provides vasoconstriction.

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55. A system, comprising:
an implantable medical device, comprising:
 a can that houses circuitry configured to provide one or both of cardiac monitoring and cardiac stimulation; and
5 a lead coupled to the can, the lead comprising a lead body and an electrode coupled to the lead body, the electrode configured for subcutaneous non-intrathoracic placement within a patient; and
 a driver apparatus detachably coupled to the implantable medical device, the driver apparatus configured to facilitate phoresis delivery of a pharmacological agent
10 from one or both of the can and the lead.
56. The system according to claim 55, wherein the driver apparatus facilitates electrophoresis delivery of the pharmacological agent.
- 15 57. The system according to claim 55, wherein the driver apparatus facilitates sonophoresis delivery of the pharmacological agent.
- 20 58. The system according to claim 55, wherein the lead and the can are configured to produce an electric potential between the lead and the can to provide the phoresis delivery of the pharmacological agent.
- 25 59. The system according to claim 55, wherein the driver is configured to provide a phoresis power signal to the implantable medical device.
60. The system according to claim 59, wherein the phoresis power signal is a DC voltage.

61. The system according to claim 59, wherein the phoresis power signal is an AC signal alternating at an ultrasonic frequency.

62. The system according to claim 59, wherein the phoresis power signal is
5 a DC bias voltage with an AC signal alternating at an ultrasonic frequency.

63. The system according to claim 55, wherein the pharmacological agent comprises an analgesic or anesthetic.

10 64. The system according to claim 55, wherein the pharmacological agent comprises an antibiotic or an antiseptic.

65. The system according to claim 55, wherein the pharmacological agent comprises a steroid or an anti-inflammatory agent.

15 66. The system according to claim 55, wherein the pharmacological agent comprises an agent that promotes hemostasis or provides vasoconstriction.